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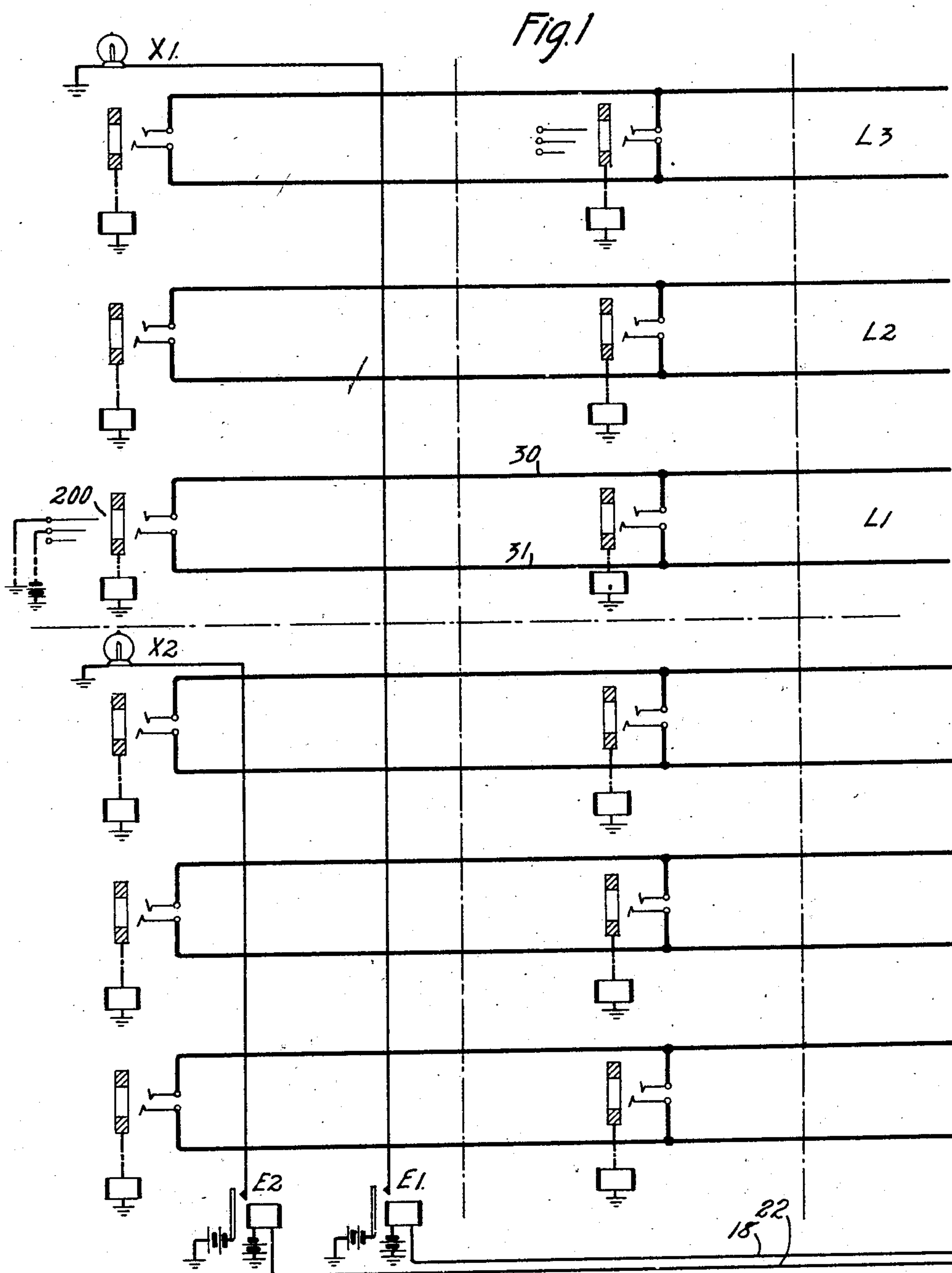
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R. S. BAILEY ET AL

STRAIGHTFORWARD TRUNKING SYSTEM

Filed Sept. 18, 1924

4 Sheets-Sheet 1



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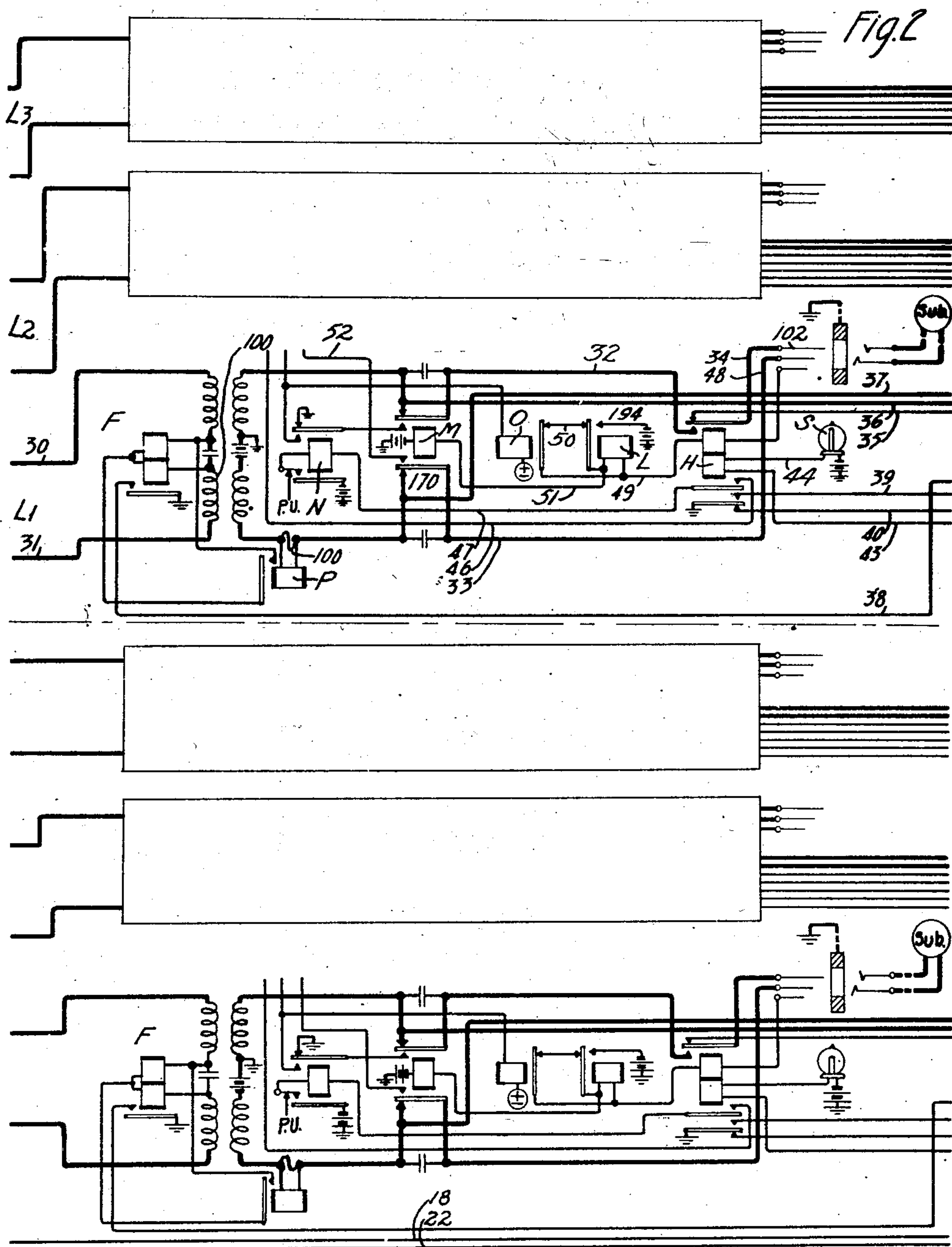
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4 Sheets-Sheet 2



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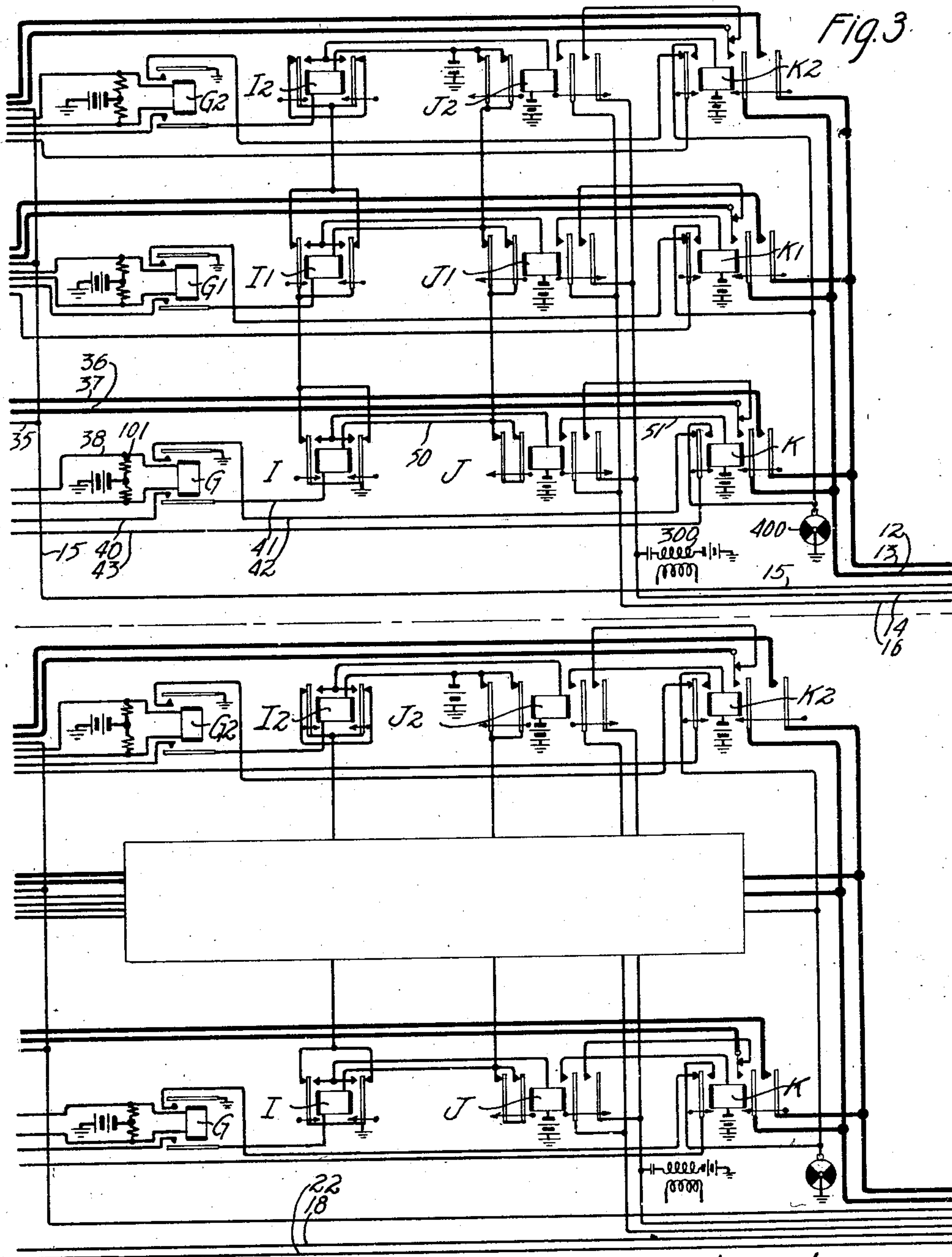
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4 Sheets-Sheet 3



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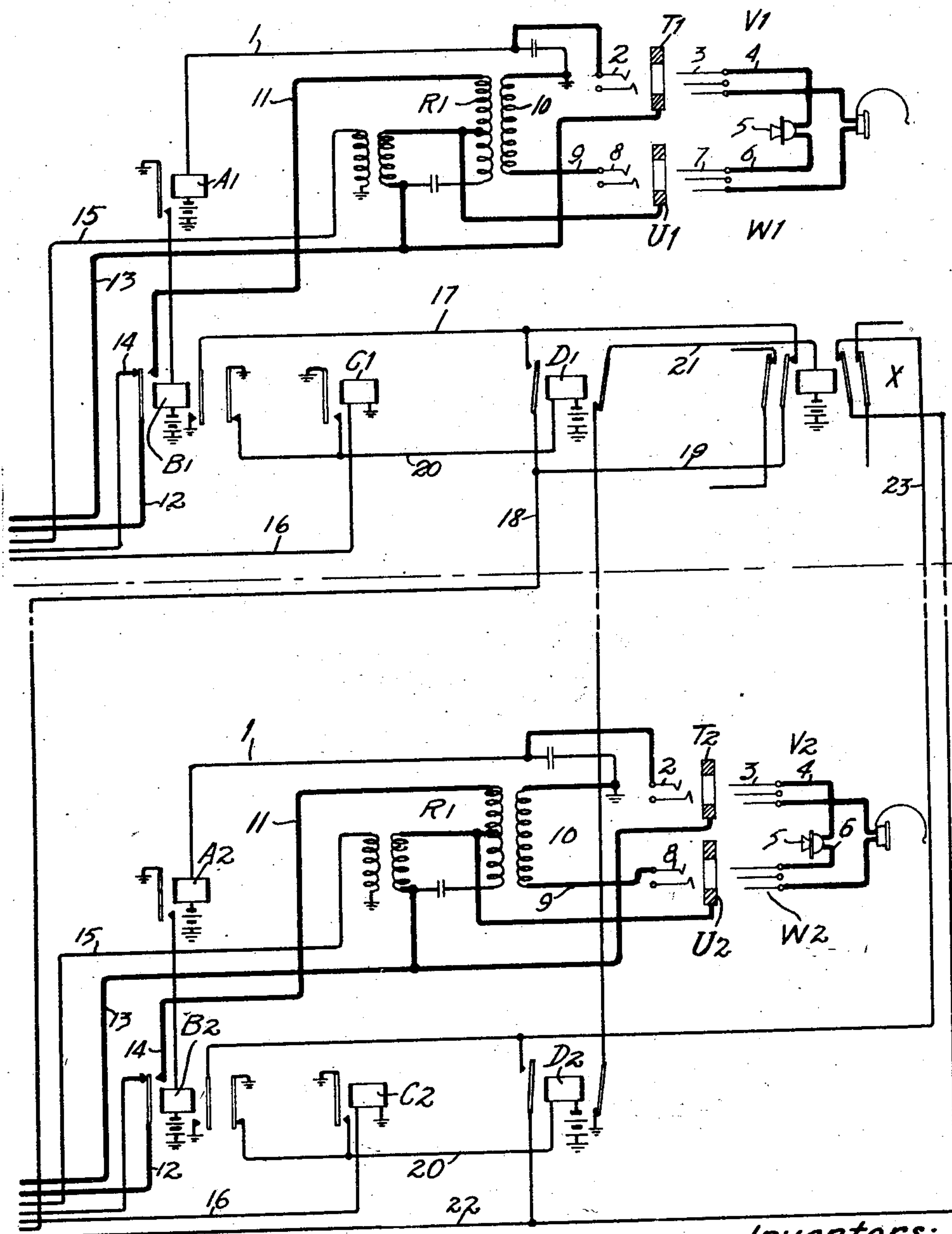
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4 Sheets-Sheet 4

Fig. 4



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UNITED STATES PATENT OFFICE.

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STRAIGHTFORWARD TRUNKING SYSTEM.

Application filed September 18, 1924. Serial No. 738,488.

This invention relates to telephone exchange systems and more particularly to trunking systems wherein "A" and "B" operators are employed in trunking calls between exchanges. In such systems, it is customary for the "A" operators to receive the calls from the calling subscribers and to extend them over a trunk line to a "B" operator in the proper exchange which "B" operator then proceeds to complete the connection.

An object of the invention is to indicate to the "A" operators the busy or idle condition of the "B" operators to whom she has trunk circuits.

A further object of the invention is to automatically connect a "B" operator's telephone to concurrently calling trunks in a predetermined sequential order.

The principal feature of the invention resides in arranging the trunks between an "A" operator's position and each "B" position in separate groups at the "A" position, locating before the "A" operator a signal corresponding to each group of trunks and providing circuit arrangements whereby when a "B" operator is at her position and idle, a corresponding signal will be displayed before each "A" operator having trunks to that "B" operator and whereby said signals will be retired when the "B" operator becomes busy or leaves the position.

Another feature of the invention resides in such an arrangement of circuits that when all of the "B" operators at the same exchange are simultaneously busy, the corresponding signals at the "A" positions will be displayed.

When an "A" operator selects an idle trunk in a group terminating in an occupied "B" position at which the "B" operator is idle as shown by the display of the corresponding group busy signal in the "A" position, the "B" operator's telephone is automatically connected to the calling trunk. After receiving the details of the desired connection from the "A" operator over the trunk, the "B" operator proceeds to complete the connection by placing the plug of the calling trunk into the outgoing jack of the desired line circuit after which her telephone is automatically disconnected and

is ready to be connected to another trunk in a similar manner. In case, however, a plurality of concurrent calls are received at the "B" operator's position while she is engaged with a previous call, her telephone set when disconnected will be automatically connected to the trunks on which calls are waiting in a definite predetermined sequential order.

Another feature of the invention therefore resides in providing a chain circuit arrangement at the "B" position whereby when a plurality of concurrent calls are received over the trunks terminating at the position, the operator's telephone thereat will be automatically connected to the calling trunks in a predetermined definite sequential order.

Other features of the invention will be apparent from the following detailed description and the drawings wherein

Figure 1 shows the trunk jacks and position busy signals located at a single "A" operator's position.

Fig. 2 shows two groups of trunks each terminating at a different "B" operator's position, the incoming ends of each trunk terminating in a plug.

Fig. 3 shows the circuit for automatically connecting the "B" operator's telephone sets with the trunks.

Fig. 4 shows two "B" operators' positions with the telephone sets and control relays.

Referring to Fig. 1, it will be noted that the trunk jacks as illustrated are shown in two groups each group being provided with a common indicating lamp.

Referring to Fig. 2, it will be noted that two groups of talking trunks are illustrated, but that the details of only a single trunk are shown in each group.

Referring to Fig. 3, the upper portion of the drawing shows in detail the control circuits for three trunks for transferring the operator's telephone set to a selected trunk while the lower portion of the drawing shows the circuits in detail for No. 1 and No. 3 trunk.

Referring to Fig. 4, two operators' telephone sets are shown. Each operator's set comprises the usual transmitter and receiver terminating in twin plugs arranged to be inserted in twin jacks connecting with the

usual repeating coil circuit. In addition to the repeating coil, a series of control relays are shown.

Various details of the circuits will be pointed out in describing the operation of the system, which is as follows:

Referring first to Fig. 4 when the plugs V^1 and W^1 of the operator's telephone set are placed in the jacks T^1 and U^1 , the following operation takes place:

Relay A^1 associated with the operator's position is operated as follows: ground, battery, winding of relay A^1 , 1, spring 2 of jack T^1 , tip conductor 3 of the plug V^1 , 4, transmitter 5, 6, 7, 8, 9, 10, to ground. Relay A^1 , operating, completes the circuit of relay B^1 and this latter relay in operating completes the circuit of relay E^1 . Fig. 1, as follows: ground, contacts of relay B^1 , 17, contacts of relay D^1 , 18, Figs. 3, 2 and 1, and winding of relay E^1 to battery and ground.

The operation of relay E^1 , completes the circuit of lamp X^1 , indicating to the "A" operator that the "B" operator is at her position and idle.

Relay A^2 is operated when the plugs V^2 and W^2 are inserted in the jacks T^2 and U^2 and causes the operation of relay B^2 . The operation of relay B^2 completes the circuit of relay E^2 as follows: ground, contacts of relay B^2 , contacts of relay D^2 , 22, Figs. 3, 2 and 1 and winding of relay E^2 to battery and ground. The operation of relay E^2 completes the circuit of lamp X^2 notifying the "A" operator that this "B" operator's position is also occupied and that the operator is idle.

In case the "B" operator at the first position withdraws the plug V^1 from the jack, then relay A^1 restores thereby releasing relay B^1 , thus completing the circuit of relay D^1 to ground through contacts of relay B^1 .

The release of relay B^1 and the operation of relay D^1 opens the circuit of relay E^1 thereby extinguishing lamp X^1 and connects the conductor extending from the right-hand armature of relay D^2 to the winding of relay X . In case the second "B" operator should withdraw the plug from the jack then relay A^2 would restore thereby releasing relay B^2 which in restoring would complete the circuit of relay D^2 . Upon the release of relay B^2 and the operation of relay D^2 the circuit of relay E^2 is opened thereby extinguishing lamp X^2 and the circuit of relay X is closed as follows: ground, contacts of relay D^2 , contacts of relay D^1 , 21, and winding of relay X to battery and ground. The operation of this relay, however, performs no useful function at this time.

In case the A operator wishes to extend a call to one of the upper groups of trunks, she tests for an idle trunk in the group if the signal lamp X^1 is lighted, and places

the calling plug into the first idle trunk jack encountered, which we will assume to be jack 200. The insertion of the plug closes the circuit of the trunk conductors 30 and 31 through the central office battery associated with the "A" operator's cord circuit, thereby causing the operation of relay F , which has its windings in series with the windings 100 of the repeating coil. The operation of relay F completes the circuit of relay G as follows: ground, contacts of relay F , 38, winding of relay G , resistance 101, battery to ground. The operation of relay G completes the circuit of slow-to-operate relay I , as follows: ground, lowermost normal contacts of relay H , 40, contacts of relay G , 41, winding of relay I , 50, normal contacts of relays J^1 and J^2 , battery to ground.

Relays J , J^1 and J^2 have their contacts in a series relation so that the battery connection just traced is reached through the higher numbered trunks. The relay I of the lowest numbered trunk will not be operated if one of the series relays in a higher numbered trunk is operated. Relay G also lights lamp S in the following circuit: ground, upper contacts of relay G , 42, contacts of relay K , 43, lower winding of relay H , lamp S , to battery and ground. Relay H does not operate in this circuit.

The operation of relay I completes the circuit of slow-to-release relay J . The operation of relay J completes the circuit of slow-to-operate relay K as follows: battery, winding of relay K , contacts of relay J , 16, winding of relay C^1 , to ground.

The operation of relay J connects the tone source 300 to conductor 36, notifying the "A" operator that the telephone set of the "B" operator is being connected to the trunk.

The operation of relay C^1 completes the circuit of relay D^1 which operates and breaks the circuit of relay E^1 causing the extinguishing of the lamp X^1 thereby indicating to other "A" operators that the "B" operator is busy.

The operation of relay K disconnects the tone source 300 from the trunk and connects the "B" operator's telephone set thereto. The operation of relay K also transfers lamp S from ground at relay G to ground through interrupter 400. The flashing of the lamp in step with the interrupter notifies the "B" operator that her telephone set is connected to that particular trunk. When the tone is disconnected from the trunk the "A" operator knows that the "B" operator is ready to receive the order and thereupon gives the number of the wanted line.

The "B" operator will thereupon take up the plug 102 of the trunk associated with lamp S and test the called line in the usual manner, and if it is idle will insert the plug. The insertion of the plug in the jack will

cause the operation of relay H, the operation of which will remove ground from conductor 40, causing the release of relays I, J and K. The release of relay K disconnects the "B" operator's telephone set from the trunk. As relay C¹ was in series with relay K it likewise restores and releases relay D¹ again allowing relay E¹ to become operated which lights the lamp X¹ indicating that this particular "B" operator's position is still occupied and again idle.

The operation of relay H connects ground to the winding of relay G over conductor 39, thereby shunting it and causing it to release. The release of relay G will open the circuit of lamp S and extinguish it.

The "B" operator rings in the usual manner. The called subscriber upon removing his receiver operates the trip relay O, thus releasing relay M to disconnect ringing current from the called line and cause the talking conductors to be closed. When the called party answers supervisory relay P is also energized, thereby shunting the upper winding of relay F, thus decreasing the resistance, bridged across conductors 30 and 31 extending to the "A" operator's position. The decreased resistance allows the marginal supervisory relay in the "A" operator's cord circuit (not shown) to become energized thereby extinguishing the supervisory lamp which serves as a notice to the "A" operator that the called subscriber has answered.

When the called subscriber replaces his receiver relay P becomes deenergized removing the shunt from the upper winding of relay F, thus restoring the original resistance across the conductors 30 and 31. The increased resistance allows the supervisory relay in the "A" operator's cord circuit to restore and operate the lamp notifying the operator that the conversation has terminated.

The "A" operator withdrawing the plug from the trunk jack 200 causes the restoration of relay F which removes ground from conductor 38 extending to relay G allowing it to again operate, this time from ground, at the lower alternate contacts of relay 4. The "B" operator's telephone will not be reconnected as ground has been removed from conductor 40 by the operation of relay H.

The re-operation of relay G again connects ground to lamp S through lower winding of relay H and contacts of relay K. The lighting of the lamp notifies the "B" operator that the connection should be taken down and she thereupon removes the plug 102 from the jack of the called line.

In case more than one call is waiting at the time the "B" operator disposes of a call then the call on the next higher numbered trunk will receive preference. Relays J, J¹

and J² are slow in releasing their armatures, so that if trunk L² is being disconnected from the operator's telephone set and calls are waiting on L³ and L¹, then the time interval will allow trunk L³ in the series to become connected to the "B" operator's telephone set in preference to L¹ as relay I cannot operate, due to its operating circuit being open at the left-hand back contacts of relay J¹.

If two or more calls arrive simultaneously when the "B" operator is idle then the preference will be given to a lower numbered trunk as the ground supply for contacts of relays I, I¹ and I² is supplied through contacts of relay I of the lower numbered trunk.

In case all of the "B" operators' positions are busy then relays corresponding to relays C¹ and D¹ of each "B" operator's position, such as C², D², etc., would be energized and likewise relay X. This latter relay is only energized when all the relays corresponding to relay D¹ are operated as its operating circuit is in series with make contacts of all of these relays. In case all relays corresponding to C¹ and D¹ are operated, then ground would be connected over make contacts of relay X to relays corresponding to E¹ and E², thereby causing the lighting of all the signal lamps grouped at the "A" operators' positions corresponding to occupied "B" positions. For illustration, the circuit of relay E¹ would be completed as follows: ground, contacts of relay B¹, 17, contacts of relay X, 19, 18, winding of relay E¹. The operation of relay E¹ causes lamp X¹ to light. The circuits of all the other lamps would be lighted over similar paths. It will be obvious that the relays corresponding to B¹ at positions not occupied would be in normal position and, therefore, the corresponding lamp at the "A" position would not be lighted as ground to operate the E relay is supplied through the contacts of the B relay.

Relay X would be provided with a pair of contacts for each of said lamps and the connection from its winding would pass in series through the contacts of corresponding relays B¹ of each "B" operator's position.

In case there are a large number of "B" operators' positions, it might be advisable to provide extra relays X having their windings in multiple, and the contacts for causing the lighting of the lamps at the "A" operators' positions can be arranged in groups, a certain group being allotted to each relay.

While Fig. 1 shows but a single lamp at but one "A" operator's position for each group of trunks, it of course, follows that there would be a lamp for each group of trunks at each "A" operator's position to

which trunks are multiplied, in which event there would be multiple jacks at each position as shown in Fig. 1.

What we claim is:

1. In a telephone system, an "A" operator's position, a "B" operator's position including a telephone set, means for rendering said telephone set operative when said position is occupied and for rendering said set inoperative when said position is unoccupied, a plurality of trunks extending between said positions, means for automatically connecting said telephone set to said trunks, a signal at said "A" operator's position associated with said trunks, means responsive to said first means for controlling said signal and means responsive to said second means for further controlling said signal.

2. In a telephone system, an "A" operator's position, a plurality of "B" operator's positions each including a telephone set, a group of trunks extending from each of said "B" operator's positions to said "A" operator's position, means at each of said "B" operators' positions for automatically connecting the said telephone set to said trunks, a signal at said "A" operator's position common to each said group of trunks, means responsive to said first means for controlling said signals and additional means responsive to the simultaneous operation of all of said first means for further controlling said signals.

3. In a telephone exchange system, the combination of an "A" and a "B" operator's position, a plurality of trunks therebetween, link circuits at said "A" position for extending calls over said trunks to said "B" position, an operator's telephone at said "B" position, means at said "B" position for automatically connecting said telephone to one of said trunks when it is seized by one of said link circuits and other means at said "B" position operative if a plurality of said trunks are concurrently seized for automatically controlling the connection of said operator's telephone to said seized trunks in a predetermined sequential order.

4. In a telephone exchange system, the combination of an "A" operator's position, a plurality of trunks terminating in jacks at said position, a signal lamp common to said jacks, a "B" operator's position including an operator's telephone common to said plurality of trunks, means under control of the "A" operator for selecting an idle one of said trunk jacks, and automatic means for causing the "B" operator's telephone to be connected to the selected trunk and for controlling the operation of said signal lamp.

5. In a telephone exchange system, an operator's position, an operator's telephone associated therewith, a plurality of trunk circuits incoming to said position, means at said position for controlling the automatic connection of said operator's telephone to said

trunks in a predetermined sequential order when a plurality of calls are concurrently extended to said position over said trunk circuits and means for momentarily applying a source of tone current to the trunk while the operator's telephone is being connected thereto.

6. In a telephone exchange system, an operator's position, an operator's telephone associated therewith, a plurality of trunk circuits incoming to said position, means at said position for controlling the automatic connection of said operator's telephone to said trunks in a predetermined sequential order when a plurality of calls are concurrently extended to said position over said trunk circuits and a signal lamp at said position individual to each trunk circuit, means for lighting one of said lamps when a call is extended over its associated trunk circuit and means for flashing said lamp when said operator's telephone is connected to the trunk.

7. In a telephone system, a group of trunks, an operator's position at the incoming ends of said trunks, means responsive to the occupation of said operator's position for rendering said trunks available for use and a signal common to said trunks at the outgoing ends thereof responsive to said means.

8. In a telephone system, a group of trunks, an operator's position at the incoming ends of said trunks, an operator's headset for connection to said position, means responsive to the connection of said headset to said position for rendering said trunks available for use, and a signal common to said trunks at the outgoing ends thereof responsive to said means.

9. In a telephone system, a group of trunks, an operator's position at the incoming ends of said trunks, an operator's headset for connection to said position, a relay responsive to the connection of said headset to said position, means responsive to the operation of said relay for rendering said trunks available for use and a signal common to said trunks at the outgoing ends thereof responsive to said relay.

10. In a telephone system, a group of trunks, an operator's position at the incoming ends of said trunks, an operator's headset for connection to said position, a relay responsive to the connection of said headset to said position, means responsive to the seizure of one of said trunks at the outgoing end thereof for connecting a source of tone to said seized trunk, means responsive to the operation of said relay for rendering said connection of said source of tone of only momentary duration, and a signal common to said trunks at the outgoing ends thereof responsive to said relay.

11. In a telephone system, a group of

trunks, means at the incoming ends of said trunks for rendering said group of trunks available for use, a signal common to said trunks at the outgoing ends thereof responsive to said means, and additional means responsive to the seizure of any one of said trunks for further controlling said signal.

12. In a telephone system, a group of trunks, an operator's position at the incoming ends of said trunks, means responsive to the occupation of said operator's position for rendering said trunks available for use, a signal common to said trunks at the outgoing ends thereof responsive to said means, and additional means responsive to the seizure of any one of said trunks for further controlling said signal.

13. In a telephone system, a group of trunks, an operator's position at the incoming ends of said trunks, means responsive to the occupation of said operator's position for rendering said trunks available for use, a signal lamp common to said trunks at the outgoing ends thereof, means for energizing said lamp responsive to said first means and additional means responsive to the seizure of any one of said trunks for deenergizing said lamp.

In testimony whereof, we have signed our names to this specification this 16th day of September, 1924.

RAND S. BAILEY.
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